WE CLAIM:

1. A PSA apparatus, comprising adsorbers with contaminant-sensitive adsorbents having a feed end fluidly coupled to a breather through a shutoff valve closed during production and open during shutdown.

2. The apparatus according to claim 1 where the PSA apparatus is a fast cycle apparatus.

3. The apparatus according to claim 2 where the PSA apparatus operates at a cycle frequency of at least 30 cycles per minute.

4. The PSA apparatus according to claim 1 where the contaminant is water.

5. The apparatus according to claim 4 where the breather includes a guard material.

6. The apparatus according to claim 1 where the feed end includes a feed plenum, an exhaust plenum or both.

7. The apparatus according to claim 6 comprising a feed plenum layered with an exhaust plenum.

8. The apparatus according to claim 1 where the adsorbers comprise a first material for adsorbing the contaminant and a second adsorbent material for product production.

9. The apparatus according to claim 8 where the first material comprises a mixture of materials.

10. The apparatus according to claim 9 where the mixture of materials includes a

first desiccant that is different from a second material.

11. The apparatus according to claim 1 where the adsorber is a parallel passage monolith.

12. The apparatus according to claim 1 where the adsorber is a laminate.

13. The apparatus according to claim 10 where the desiccant is in a first zone and the adsorbent is in a second zone along a feed direction.

14. The apparatus according to claim 13 having a first desiccant zone having a desiccant, the desiccant zone being isolated on shutdown from an adsorbent zone having an adsorbent sensitive to water by a shut off valve in line between the desiccant zone and the adsorbent zone.

15. The apparatus according to claim 14 where the desiccant is housed in a first module separate from but fluidly coupled to a second module housing the adsorbent through a shut off valve in a fluid conduit coupling the first module and the second module.

16. The apparatus according to claim 1 further having a product delivery compartment that receives a buffer gas having a water vapor content substantially the same as or less than the product.

17. The apparatus according to claim 16 where the buffer gas is a product gas produced by pressure swing adsorption over the adsorbers.

18. The apparatus according to claim 1 comprising a rotary PSA apparatus.

19. A PSA apparatus comprising adsorbers having contaminant-sensitive adsorbents with a product end fluidly coupled to a buffer chamber that receives a flowing buffer

gas having a water vapor content substantially the same as or less than a product gas produced by a pressure swing adsorption process over the adsorbers.

20. The apparatus according to claim 19 where the buffer gas pressurizes the to product delivery compartment to a pressure above ambient.

21. The apparatus according to claim 19 operating at a cycle frequency of at least 30 cycles per minute.

22. The apparatus according to claim 19 where the buffer gas is the product gas.

23. The apparatus according to claim 19 further comprising at least a buffer chamber seal to substantially fluidly seal the buffer chamber.

24. The apparatus according to claim 19 where a feed end of the adsorbers is fluidly coupled to a breather.

25. The apparatus according to claim 24 where the breather includes a guard material.

26. The apparatus according to claim 24 and further including an isolation valve in a feed gas path between the breather and the adsorbers.

27. The apparatus according to claim 19 where the adsorbers comprise laminates having a first material for separating a contaminant and a second material for separating a product fluid from a fluid mixture.

28. The apparatus according to claim 27 where the first material is a mixture of materials, the second material is a mixture of materials, or both.

29. The apparatus according to claim 19 where the contaminant is water adsorbed by the first material in a first guard layer along a fluid feed direction.

30. The apparatus according to claim 29 where the zones are separated.

31. The apparatus according to claim 19 where the first material can be fluidly isolated from the second material upon shutdown.

32. The apparatus according to claim 31 having a shut off valve in a fluid path between the first zone and the second zone.

33. The apparatus according to claim 30 where the first material is housed in a first module separate from a second module housing the second material, the apparatus further having an isolation valve in a fluid path between the first module and the second module.

34. The apparatus according to claim 19 further comprising a parking seal.

35. A PSA apparatus, comprising an adsorber having at least one contaminant-sensitive adsorbent with a feed end fluidly coupled to a breather and a product end fluidly coupled to a product delivery compartment fluidly coupled to a product delivery line for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent, the product delivery compartment receiving a buffer gas having a water vapor content substantially the same as or less than the product gas.

36. The apparatus according to claim 35 where the PSA apparatus is a fast cycle rotary PSA apparatus.

37. The apparatus according to claim 36 where the PSA apparatus operates at a cycle frequency of at least 3 cycles per minute.

38. The apparatus according to claim 28 where the contaminant is water and the breather includes a guard material.

39. The apparatus according to claim 25 where the feed end includes a feed plenum layered with an exhaust plenum.

40. The apparatus according to claim 35 where the adsorber is a laminate having a first material acting as a guard material to adsorb water and a second adsorbent material for producing a product gas.

41. The apparatus according to claim 35 where the contaminant is water, the adsorber includes a first material acting as a desiccant to adsorb the water in a first zone, the absorber including a second material is in a second zone along a feed direction.

42. A PSA apparatus operating at a cycle speed of at least 3 cycles per minute, comprising:

a breather; and

adsorbers having at least one guard layer with a guard material and at least a second contaminant-sensitive adsorbent zone with an adsorbent for producing product fluid, a feed end of the adsorbers fluidly coupled to the breather and a product end of the adsorbers being fluidly coupled to a product delivery compartment fluidly coupled to a product delivery line for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent, the product delivery compartment receiving a buffer gas having a contaminant vapor content substantially the same as or less than the product gas.

43. The apparatus according to claim 42 having an isolation valve in a fluid path between the guard layer and the adsorbent zone.

44. The apparatus according to claim 42 having an isolation valve in a fluid path between the breather and a feed end of the adsorbers.

45. The apparatus according to claim 42 where the guard material is housed in a first module separate from a second module housing the adsorbent, the apparatus further having an isolation valve in a fluid path between the first module and the second module.

46. A fast cycle, rotary PSA apparatus, comprising:

a breather fluidly coupled to a feed plenum;

a rotor for housing adsorbers and rotating the adsorbers to receive feed fluid from the plenum at normal process rotary speeds at least as high as 30 cycles per minute;

plural adsorbers housed in the rotor and having a first end which receives feed fluid from the feed plenum and a second end positioned to deliver product gas produced a pressure swing adsorption process to a product delivery compartment, the adsorbers comprising at least a first material for removing a contaminant and a second material for producing a product fluid;

seals for sealing a buffer chamber about the light product delivery compartment, the buffer chamber receiving a gas having a contaminant vapor content the same as or less than the product gas;

a product delivery conduit for delivering a desired product gas;

a light reflux conduit for delivering a portion of product gas as reflux gas; and

at least one guard trap in the product delivery conduit or the light reflux conduit.

47. The apparatus according to claim 46 where the contaminant is water.

48. The apparatus according to claim 47 where the breather includes at least a material acting as a desiccant to remove water.

49. The apparatus according to claim 46 where the feed plenum is layered with an exhaust plenum.

50. The apparatus according to claim 46 comprising a compartment for housing the first material and a second compartment for housing the second material with an isolation valve

in a fluid path therebetween for fluidly isolating the first compartment from the second compartment.

51. The apparatus according to claim 49 where the first compartment is housed in a first housing separated from but fluidly coupled to a housing for the second compartment.

52. The apparatus according to claim 46 and including a product fluid line fluidly coupled to a product end of the adsorbers for receiving product gas and delivering at least a portion of the product gas to the buffer chamber.

53. The apparatus according to claim 46 and further comprising desiccant compartments for placing desiccant adjacent at least one valve or at least one port.

54. The apparatus according to claim 46 where the product delivery conduit includes an isolation valve to reduce back diffusion or mixing of a second gas having a higher moisture content than the product gas into the product delivery conduit.

55. The apparatus according to claim to claim 46 and further comprising an auxiliary guard trap fluidly coupled to a product gas delivery conduit so that the auxiliary guard trap is regenerated during normal operation.

56. The apparatus according to claim 55 where the guard trap is regenerated by at least one of a dry product or thermal swing.

57. The apparatus according to claim 46 achieving substantially complete regeneration of the adsorbers guard layer by a displacement purge to transfer adsorbed contaminant vapor form an adsorbent guard layer to an auxiliary desiccant bed.

58. The apparatus according to claim 46 where the contaminant is water, the apparatus further having an auxiliary desiccant bed with a water vapor capacity sufficient to

adsorb substantially all the water vapor desorbed from the first material.

59. The apparatus according to claim 46 having an exhaust purge valve open during normal operation to discharge exhaust fluid to atmosphere, a desiccant bed isolation valve for isolating an auxiliary desiccant bed for countercurrent regeneration flow of product gas, and a product reflux valve for isolating product gas reflux during counter current regeneration flow through the auxiliary desiccant bed.

60. The apparatus according to claim 55 where the apparatus further includes a humidity sensor for sensing water vapor from the auxiliary desiccant bed.

61. The apparatus according to claim 46 further comprising heating means for heating the first material.

62. The apparatus according to claim 46 where the absorbers have plural contaminant adsorbent zones, plural adsorbent zones for producing fluid product, or both.

63. The apparatus according to claim 46 further comprising a parking seal.

64. The apparatus according to claim 40 comprising check valves to prevent forward flow from a zone having the first material to a zone having the second material except during normal operation of the PSA module, the check valve being actuated by an actuator.

65. The apparatus according to claim 46 including an isolation valve in a fluid path between the breather conduit and the absorbers to prevent flow to the feed ends of the adsorbers.

66. The apparatus according to claim 46 where the breather is an inflated bag diaphragm.

67. The apparatus according to claim 46 where the breather is fluidly coupled to an auxiliary desiccant bed external to the PSA module.

68. The auxiliary desiccant bed according to claim 67 coupled to a heater.

69. The apparatus according to claim 46 further comprising a moisture trap in the product delivery conduit.

70. The apparatus according to claim 46 further comprising a moisture trap in at least one product reflux delivery conduit.

71. The apparatus according to claim 70 further comprising means for rotating desiccant traps between the product reflux lines and the product line, for displacement purged regeneration by the product.

72. The apparatus according to claim 62 where the means for rotating comprises a rotary adsorption module that rotates through discrete fractional rotations at discrete intervals to switch desiccant beds from humidity adsorption from each of several product reflux loops to regeneration when fluidly coupled to the product.

73. A method for reducing adsorbent degradation by moisture adsorption while producing a product gas in a pressure swing adsorption process, comprising:

providing a PSA apparatus comprising adsorbers with contaminant-sensitive adsorbents having a feed end fluidly coupled to a breather through an isolation valve; and

using the PSA apparatus to product gas.

74. The method according to claim 73 where the contaminant is water.

75. The method according to claim 73 where the PSA apparatus is a fast cycle apparatus.

76. The method according to claim 75 where the PSA apparatus is a rotary apparatus operating at a cycle frequency of at least 30 cycles per minute.

77. The method according to claim 74 where the adsorbers comprise a first material that acts as a desiccant to adsorb water and a second material to product a product fluid by a pressure swing.

78. The method according to claim 77 having a first zone with the first material, the desiccant zone being isolated on shutdown from an adsorbent zone having the second material sensitive to water by an isolation valve in a fluid path between the desiccant zone and the adsorbent zone.

79. The method according to claim 73 further comprising introducing to a product delivery compartment a product gas produced by pressure swing adsorption over the adsorbers.

80. A method for reducing adsorbent degradation while producing a product gas in a pressure swing adsorption process, comprising:

providing a fast cycle PSA apparatus comprising adsorbers having contaminant-sensitive adsorbents with a product end fluidly coupled to a product delivery compartment that receives a buffer gas having a water vapor content substantially the same as or less than a product gas produced by a pressure swing adsorption process over the adsorbers; and

using the PSA apparatus.

81. The method according to claim 80 where the PSA apparatus further comprises a breather fluidly coupled to a feed end through an isolation valve in a fluid path between the breather and the adsorbers.

82. A method for reducing adsorbent degradation while producing a product gas in a pressure swing adsorption process, comprising:

providing a PSA apparatus comprising a breather fluidly coupled to a feed plenum, a rotor for housing adsorbers and rotating the adsorbers to receive feed fluid from the plenum at normal process rotary speeds at least as high as 30 cycles per minute, plural adsorbers housed in the rotor and having a first end which receives feed fluid from the feed plenum and a second end positioned to deliver product gas produced by a pressure swing adsorption process to a product delivery compartment, the adsorbers comprising at least a first desiccant zone and a second adsorbent zone, seals for sealing a buffer chamber about the light product delivery compartment, the buffer chamber receiving a gas having a water vapor content the same as or less than the product gas, and a product delivery conduit for delivering a desired product gas; and

using the PSA apparatus.

83. A method for shutting down a PSA apparatus according to a shutdown sequence, comprising:

operating a rotary PSA apparatus having a feed end fluidly coupled to a first end of adsorbers that include a first material for adsorbing a contaminant and at least one contaminant-sensitive adsorbent for producing a product fluid by pressure swing adsorption, the PSA apparatus further including a product end coupled to a second end of the adsorbers for delivering a product fluid;

discontinuing product fluid delivery;

exhausting feed gas;

introducing a blanket gas into a feed end of the PSA apparatus;

discontinuing delivery of fluid feed mixture to the feed end; and

purging the adsorbers with a purge fluid.

84. The method according to claim 83 and further comprising preparing the apparatus for elevated pressure parking, the method comprising closing an exhaust port and introducing a blanket gas into the feed end to pressurize the apparatus to a pressure above ambient.

85. The method according to claim 84 where the apparatus is pressurized to a park pressure of at least 0.5 bar above ambient.

86. The method according to claim 83 further comprising discontinuing rotor rotation and engaging any parking seal.

87. The method according to claim 83 and further comprising heating the first material to facilitate desorption of adsorbed contaminant.

88. The method according to claim 83 where the contaminant is water.

89. The method according to claim 87 and further comprising cooling the desiccant after purge.

90. The method according to claim 83 where exhausting feed gas is used to increase delta X.

91. The method according to claim 83 where the contaminant is water and the adsorbers are purged using a purge gas having a water vapor content substantially equal to water vapor content of the product gas produced by a PSA process over the adsorbers

92. A method for shutting down a PSA apparatus according to a shutdown sequence, comprising:

operating a rotary PSA apparatus having a feed end fluidly coupled to a first end of adsorbers that include an adsorbent material acting as a desiccant to adsorb water and at least one water-sensitive adsorbent and a product end coupled to a second end of the adsorbers for delivering a product gas;

discontinuing delivery of product fluid;

exhausting feed gas to increase delta X;

introducing a blanket gas into a feed end of the PSA apparatus;

heating the desiccant to facilitate desorption of adsorbed water;

discontinuing delivery of fluid feed mixture to the feed end;

purging the adsorbers with a purge fluid having a water vapor content substantially equal to water vapor content of the product gas produced by a PSA process over the adsorbers;

stopping all purge operations;

closing an exhaust port and introducing a second blanket gas into the feed end to pressurize the apparatus to a pressure above ambient;

discontinuing rotor rotation; and

engaging any parking seal.

93. The method according to claim 92 where the adsorber purge fluid is at a temperature higher than the adsorbers and purging the adsorbers with the adsorber purge fluid heats the adsorbers.

94. The method according to claim 92 where the adsorber purge fluid is the product fluid.

95. The method according to claim 92 and further comprising heating the desiccant with heating means.

96. The method according to claim 95 where the heating means comprise using microwave or infrared radiation.

97. The method according to claim 92 where the product fluid is recirculated through an auxiliary desiccant bed prior to purging the adsorbers.

98. A method for increasing operation time before shutdown is required of a rotary fast cycle PSA apparatus, comprising:

providing a PSA unit having a feed air dryer upstream of a feed end of the PSA unit, and adsorbers having a desiccant layer at the feed end of the adsorbers; and

operating the PSA unit under normal operating conditions useful for producing a product fluid.

99. The method according to claim 98 where the adsorbers are provided as high surface area laminated adsorbers, with the adsorbent supported in thin adsorbent sheets separated by spacers to define flow channels between adjacent sheets.

100. The method according to claim 99 where the laminated adsorbers include a desiccant layer for adsorbing a water at the feed end of the sheets.

101. The method according to claim 99 where the desiccant is selected from the group consisting of alumina, aluminosilicate gels, silica gels, zeolites, such as zeolite Y materials, activated carbon, carbon molecular sieves and combinations of these materials.

102. The method according to claim 98 and further comprising providing a buffer space between the internal working zone of valves communicating to the product ends of the adsorbers, the buffer space being a positive pressured dry fluid flushed zone.

103. The method according to claim 102 where the buffer chamber has flushing circulation provided by delivered product flow.

104. The method according to claim 98 comprising placing a contaminant trap in at least one light reflux line of the PSA apparatus.

105. The method according to claim 104 where the contaminant trap adsorbs water.

106. The method according to claim 104 where activity of the contaminant trap is maintained by periodic regeneration or replacement.

107. The method according to claim 98 and further comprising placing a desiccant

trap in the product line.

108. The method according to claim 96 where a target water vapor pressure at the product end is substantially that of the selected adsorbent material at the product end.

109. The method according to claim 108 where the water vapor pressure ranges from about 0.005 Pa to about 0.01 Pa at 30°C.

110. A method for producing a positive pressure park mode in a fast cycle rotary PSA apparatus, comprising:

shutting down a rotating PSA system to reduce desiccant water loading;

introducing a fluid into a feed end of the apparatus to provide a park pressure above ambient;

closing all ports and discontinuing rotor rotation; and

engaging a parking seal.

111. A fast cycle rotary PSA apparatus, comprising adsorbers with contaminant adsorbing materials, the adsorbers comprising a guard layer positioned first along a fluid feed path and contaminant sensitive adsorbents positioned second along a fluid feed.

112. The apparatus according to claim 111 where the guard layer is isolated from the contaminant-sensitive adsorbents.

113. The apparatus according to claim 111 further including an isolation valve in a fluid flow path between the guard layer and the contaminant-sensitive adsorbents.

114. The apparatus according to claim 111 where the contaminant is water, and the guard layer includes a desiccant.

115. The apparatus according to claim 111 where the apparatus operates at a rotary

cycle speed of greater than 10 cycles/minute.

116. The apparatus according to claim 111 where the apparatus operates at a rotary cycle speed of greater than 30 cycles per minute.

117. The apparatus according to claim 111 where the apparatus includes a fluid product line, a fluid reflux line or both, and further includes at least one contaminant trap in the fluid product line, the fluid reflux line, or both.

118. The apparatus according to claim 117 further including plural contaminant traps.

119. The apparatus according to claim 117 where the contaminant trap is a water trap having a desiccant.

120. The apparatus according to claim 119 where the contaminant trap is fluidly coupled to a fluid flow for regenerating the trap.

121. The apparatus according to claim 120 where the contaminant trap is coupled to heating means for heating the trap to facilitate desorbing adsorbed contaminants.

122. A method for shutting down a PSA apparatus according to a shutdown sequence, comprising:

operating a PSA apparatus having a feed end fluidly coupled to a first end of adsorbers that include a guard layer and at least one contaminant-sensitive adsorbent, the PSA apparatus further including a product end coupled to a second end of the adsorbers for delivering a product fluid;

stopping delivery of product fluid;

purging adsorbers with product flow; and

heating the guard layer.

123. The method according to claim 122 and further comprising cooling the adsorbers.

124. The method according to claim 122 where heating the guard layer comprises directly heating the guard layer using heating means.

125. The method according to claim 124 where the heating means include resistance heating, microwave heating, infra red heating, SEAL FRICTION, reducing cooling load, and combinations thereof.

126. The method according to claim 122 where the guard layer is heated by fluid flow.

127. The method according to claim 122 where the guard layer is heated by compressor work, resistance heating, adsorption heating of upstream guard trap, using a heat exchanger, and combinations thereof.

128. A PSA apparatus, comprising:

at least one adsorber having at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the buffer seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer

space comprising at least one buffer chamber having an entry aperture and an exit aperture that provides for flow of a buffer fluid in a direction from the process containment seal to the buffer seal.

129. The apparatus according to claim 128 where the second component of the apparatus is a mating component of the process containment seal or the buffer seal.

130. The apparatus according to claim 128 where the contaminant is water.

131 A rotary bed PSA apparatus, comprising:

at least one adsorber having at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent, the adsorber being rotated by a rotor relative to a stator;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the buffer seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer space comprising at least one buffer chamber having an entry aperture port and an exit aperture that provides for flow of a buffer fluid through the buffer chamber.

132. The apparatus according to claim 131 where there is a pressure differential across the apertures to allow fluid flow.

133. A PSA apparatus operating at a PSA cycle frequency of 20 cycles per minute or greater, comprising:

at least one adsorber having at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer space comprising at least one buffer chamber.

134. The apparatus according to claim 3 comprising plural process containment seals, the apparatus further comprising a buffer chamber for minimizing flow of contaminant towards the product end of the adsorber for each of the plural process containment seals.

135. The apparatus according to claim 3 comprising plural process containment seals, the apparatus further comprising a buffer chamber for minimizing flow of contaminant towards the product end of the adsorber for at least two of the plural process containment seals.

136. A PSA apparatus, comprising:

at least one adsorber having at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a

first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the buffer seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer space comprising plural buffer chambers defined by plural dynamic seals for minimizing contaminant flow therebetween, where a buffer chamber other than the buffer chamber immediately adjacent the containment process seal has a first aperture and a second aperture that allow fluid flow through the buffer chambers.

137. The apparatus according to claim 136 where plural buffer chambers other than the buffer chamber immediately adjacent the containment process seal have a first aperture and a second aperture that allow fluid flow through the buffer chambers.

138. A PSA apparatus, comprising:

at least one adsorber having at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the buffer seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer space comprising at least one buffer chamber defined by plural dynamic seals for partitioning two fluids therebetween, the buffer chamber being at a lower pressure than the contaminant-comprising fluid.

139. The apparatus according to claim 138 further comprising reducing the pressure of the buffer chamber relative to the contaminant-comprising fluid using a fluid pump.

140. The apparatus according to claim 138 further comprising a conduit from the buffer chamber to an exhaust.

141. The apparatus according to claim 138 further comprising a conduit from the buffer chamber to atmosphere.

142. A PSA apparatus, comprising:

at least one adsorber having at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the buffer seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer space comprising at least one buffer chamber having a guard trap.

143. A rotary PSA apparatus, comprising:

at least one adsorber having at least one guard layer and at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a

first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the buffer seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer space comprising at least one buffer chamber.

144. A PSA apparatus operating at a cycle frequency of 20 cycles per minute or greater, comprising:

at least one adsorber having at least one guard layer and at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the buffer seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer space comprising at least one buffer chamber.

145. A PSA apparatus, comprising:

an air breather;

at least one adsorber having at least one contaminant-sensitive adsorbent with a feed end fluidly coupled to the air breather and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a

first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the buffer seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer space comprising at least one buffer chamber.

146. A PSA apparatus, comprising:

at least one adsorber having at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus;

at least one buffer seal intended to separate a first contaminant-comprising fluid on a first side of the buffer seal from a second fluid desirably isolated from the contaminant where there is intermittent or continuous relative movement between the buffer seal and a second component of the apparatus, the process containment seal and the buffer seal defining a buffer space comprising at least one buffer chamber; and

at least one parking seal.

147. A PSA apparatus, comprising:

at least one adsorber having at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product gas enriched in a desired product produced by pressure swing adsorption over the adsorbent through a product delivery conduit;

at least one reflux line for delivering reflux gas to the adsorber;

at least one process containment seal adjacent the product end for separating a first fluid on a first side of the containment seal from a second fluid on a second side of the containment seal, with intermittent or continuous relative movement between the containment seal and a second component of the apparatus; and

at least one guard trap in the product delivery conduit, the reflux line, or both.

148. The apparatus according to claim 147 comprising plural guard traps.

149. A PSA apparatus, comprising at least one adsorber having at least one guard layer and at least one contaminant-sensitive adsorbent with a feed end and a product end for delivering a product fluid enriched in a desired product produced by pressure swing adsorption over the adsorbent, the guard layer being effective to ensure that contaminant water concentration of the fluid from the guard layer is no greater than that of the contaminant concentration in fluid from the contaminant-sensitive adsorbent.

150. A method for reducing adsorbent degradation by moisture adsorption while producing a product gas in a pressure swing adsorption process, comprising:

providing a PSA apparatus comprising adsorbers with a second contaminant-sensitive adsorber material receiving a feed fluid, the feed fluid contacting a first contaminant removal layer, which has been designed so that the adsorber material, which performs the main separation, suffers a limited, controlled level of deactivation when the contaminant has broken through second material product fluid and has reached equilibrium; and

using the PSA apparatus to produce a gas.

151. The method according to claim 150 where the contaminant is water.

152. The method according to claim 150 where the PSA apparatus is a fast cycle apparatus.

153. The method according to claim 152 where the PSA apparatus is a rotary apparatus operating at a cycle frequency of at least 3 cycles per minute.

154. The method according to claim 151 where the adsorbers comprise a first material that acts as a desiccant to adsorb water and a second material to product a product fluid by a pressure swing.

155. The method according to claim 154 where the allowed deactivation of the production layer is 5% or less.

156. The method according to claim 154 where the allowed deacativation of the production layer is 10% or less.

157. The method according to claim 154 where the allowed deactivation of the production layer is 20% or less.

158. The method according to claim 154 where the allowed deactivation of the production layer is 50% or less.